Protecting Senior Citizens from Cyber Security Attacks in the e-Health Scenario: An International Perspective

Haricharan Rengamani
SUNY at Buffalo, USA
harichar@buffalo.edu

Shambhu Upadhyaya
SUNY at Buffalo, USA
shambhu@buffalo.edu

H. Raghav Rao
SUNY at Buffalo, USA
mgmtrao@buffalo.edu

Ponnurangam Kumaraguru
IIIT-Delhi, INDIA
pk@iiitd.ac.in

ABSTRACT

Senior citizens represent a substantial percentage of population around the world and most of them need health care. Health care is becoming expensive around the world. As one of the cost-reduction measures, most of the health care providers are moving the patient's data into electronic format (Electronic Medical Records). Even though this migration is necessary for efficient health care service, it opens up a big can of worms with respect to security and privacy issues. In particular, when the doctors and patients access this medical information through the Internet, there is a large room for cyber security attacks. Given that the senior citizens have less resources (memory, physical energy, technical skills), developing solutions and processes, that will help them in not becoming a victim to attacks, is essential. The problem becomes more interesting when the international component comes into play – e.g., senior citizens in another country. In this research, we plan to study the social and cultural effect of using electronic health care services, and cyber security attacks due to using e-health care services. This environment of studying the cyber security issues for senior citizens, e.g., in India, presents challenges and opportunities compared to the U.S. We believe that this research will lead into developing solutions that will address cyber security problems for senior citizens both in India and in the U.S. This paper lays the foundation for research rather than a specific solution or technology or research results.

Categories and Subject Descriptors

K.6.5 Security and Protection; K.4.1 Public Policy Issues – Computer-related health issues

General Terms

Management, Privacy, Security

Keywords

e-Health, cyber crime, privacy issues, internationalization.

1. INTRODUCTION

Information and communication technologies (ICTs) have become important support systems enabling one of the fastest growing demographic groups, the elderly, to enhance their knowledge, business transactions, and social connections [5, 6]. Yet, senior citizens remain the most vulnerable in terms of online information security and privacy. Most seniors do not spend as much time on the Internet as younger consumers ("grey digital divide") and are not as knowledgeable about the Internet fraud [4]. According to the U.S. Senate Special Committee on Ageing while seniors 60 and older make up 15% of the U.S. population,[1] they account for roughly 30% of fraud victims, making them a select group for our study. In India, according to Census data 2001, the ageing (60+ years) population was around 77 million in 2001. [2]

As the ageing population is growing around the world, the health care needs for them are also exponentially growing. Large proportion of this health care is also moving towards electronic world. Even though the percentage of aged population using cyber / electronic world for health care is increasing around the world, the percentage in India is very small (in a nascent stage). This could be just because the general population (of all age groups) using the e-health services is less. In India, the amount of aged people using the Internet is very low and therefore the number of people falling for security attacks may be lower too, but these aged people are starting to use many of the e-health services where the data is mostly kept in electronic format Electronic Medical Records (EMR). EMRs are getting popular in India, where almost all the hospitals are moving their data to electronic format. Many of the senior citizens in India who are not technically savvy are also using the e-health facilities to undergo treatment in hospitals.

With the increase in percentage of senior citizens using health services where electronic records are used, there is a need to study the related security issues. This is a global problem and there is a lot of research that is getting funded in the U.S. through federal agencies such as NSF and NIH to develop solutions, technologies, and processes to reduce the effect of cyber security attacks on senior citizens. The objective of this paper is to study the senior citizens' behavior on using electronic health records and the security implications of their behavior from an international perspective.

---

[1] http://ageing.senate.gov/issues/elderfraud/index.cfm

[2] http://www.censusindia.net/

Table 1. Issues for investigation		
The role of the following issues on senior citizens' privacy and cyber security concerns, level of using electronic medical records, attitudes and online privacy technology adoption behavior will be studied		
Society/ Institutions	• cyber security education/information, cyber security education/information • privacy related law and privacy policies, cultural values • understanding of technology, and broader security and privacy issues	
Users	• age, gender, education, income, online privacy concerns • perceived risk of online privacy breach, trust of the website • perceived value of private information • age differences, gender differences, race differences	
Technology	• perceived ease of use of electronic health care services technology, perceived usefulness of online security protection technologies • understanding the advantages and limitations of the technologies in use in this regard	

As in the general population, senior citizen population in India and U.S. will have different perception to technology, privacy, and security issues [2, 3]. The social cultural aspects of human being play a big role in various important aspects of life (one of them is cyber security issues related to health care services). We propose that studying the systems, processes, and behavior in the developed nation like the U.S. (individualistic society) and compare it with data from countries like India (collectivist society) may provide a game changing strategy in addressing the cyber security issues among senior citizens in the world.

2. RESEARCH METHODOLOGY

As discussed, India has its own issues and problems to tackle in addressing the health care services for citizens of India. In this research, we propose to study the social, cultural, and technological aspects of the solutions used in health care services with respect to cyber security issues. As the first step of this study, we will interview security and privacy heads in both in the U.S. and in India (a convenience sample) to discuss the issues, challenges, and practices related to health care servicing. We also plan to interview senior citizens both in the U.S. and in India. In this regard, we will create an exhaustive list of questions that we will use to discuss with the participants in the interviews.

It is imperative that a new security framework be developed to facilitate trustworthy operations of the growing senior population. Such a framework would have to consider the following processes (and associated nodes): electronic transfer of prescriptions (e-prescription), and electronic exchange of health data between primary, secondary, and tertiary healthcare establishments (e.g., between hospitals and doctor's offices). The information exchange would concern order entry, result reporting, admission, transfer, and discharge of patients, among others [1]. At any node, there is the possibility of personal health information (PHI) leakages. An added advantage is that this framework can be extended to other populations with varying levels of vulnerability. The PIs have already carried out a preliminary in-depth focus group interview at a senior community center in Western New York. We hope to do similar studies in India among senior citizens to study their understanding of the technology, privacy and cyber security issues in the context of electronic health care services.

Table 1 presents the issues that we plan to study in this research. We will heavily focus on understanding the perception of using these electronic health services by senior citizens. We hope to collect the data at the same time at both U.S. and India so that we can do a direct comparison of the user behavior. We will collect the data from a convenience sample that is available to us both at U.S. and India.

3. PROJECT BACKGROUND

Two of the authors of this paper are already working on an NSF research grant "Online Privacy and Senior Citizens: A Socio-Technical Multi-Perspective Framework for Trustworthy Operation" where the goal is to study the elderly population with respect to their Internet use, security, and privacy issues. This research aims to develop a computational framework for online privacy protection of senior citizens. However, in the research on e-Health, we plan to internationalize the issues but keep the focus on protecting senior citizens from cyber security attacks. In the next section, we identify the specific sources of health information leaks that could also have an impact on senior citizens.

4. PHI LEAKS - SENIOR CITIZENS

Personal Health Information [PHI] leak is definitely a nightmare for all the healthcare providers, insurance companies and pharmacies dealing with the confidential information of the patients and the consequence can be really devastating. Most of the PHI Leaks happen through the various channels of the Internet. A recent study shows that the percentage of senior citizens who started using the Internet had grown to 45% in recent years from just 26% in 2005 [7]. With the rise of users (specifically senior citizens) rises the risk too. There are many ways by which the senior citizens are exploited and become victims of Identity theft. Few of the ways by which PHI can be compromised are [8]:

i) Scammers use telephones as a powerful tool to deceive senior citizens, the scammers pretend to represent trusted sources such as Charities, Police Organizations, Hospitals, Pharmacies, AARP, etc. and retrieve their confidential information.

ii) Scammers and Fraudsters use mail to phish for information from the elderly people. In this case, the mail appears to come from trustworthy sources and request for personal information of them.

iii) Lack of awareness among elderly people in dealing with all kinds of information security threats such as Virus, Malware, Spyware, Trojan horses, etc.

iv) Domestic Identity theft is one other challenge wherein the senior citizens are deceived by their own family members for financial and other material gains [9].

v) Identity thieves target lonely elderly people, gain their trust and make them victim for identity thefts (also, called Social engineering attacks). Due to the emotional state of their mind, they tend to trust people easily and share their information as they feel dejected and lonely in their last stages of life.

There are a number of other challenges for elderly people in terms of visibility, mobility, memory, learning abilities and other constraints in learning new ways and safe practices of browsing and this poses a greater threat in handling Information communication Technology [ICT] [10].

Besides, other ways/activities by which PHI leaks of patients are compromised include usage behavior of persons in health care sectors. To quote the most prominent ones [11]:

i) Sharing folders and files that have confidential data of the patients. This is mostly done by the insiders of the organization either intentionally or accidentally.

ii) Poor file organization polices of the organization, i.e., saving music files and other data in the same folder that has potential data of the patients and other resources of the organization.

iii) Downloading software from the Internet without inspecting the source. This can be malware, spywares, and other worms, viruses that can gain access to the system and steal information.

iv) Installing Peer-to-Peer software (Lime wire, BearShare, bit torrent) which leads to unintentional sharing of file directories and folders.

v) Other means of leakages include patients sharing their information in E-mails, Blogs, using FTP and Instant Messaging.

The connection map shown in Figure 1 summarizes the various sources of PHI leaks by which the PHI information is compromised. The objective of our research is to measure the severity of such attacks in the senior citizens context and develop suitable countermeasures to mitigate such attacks.
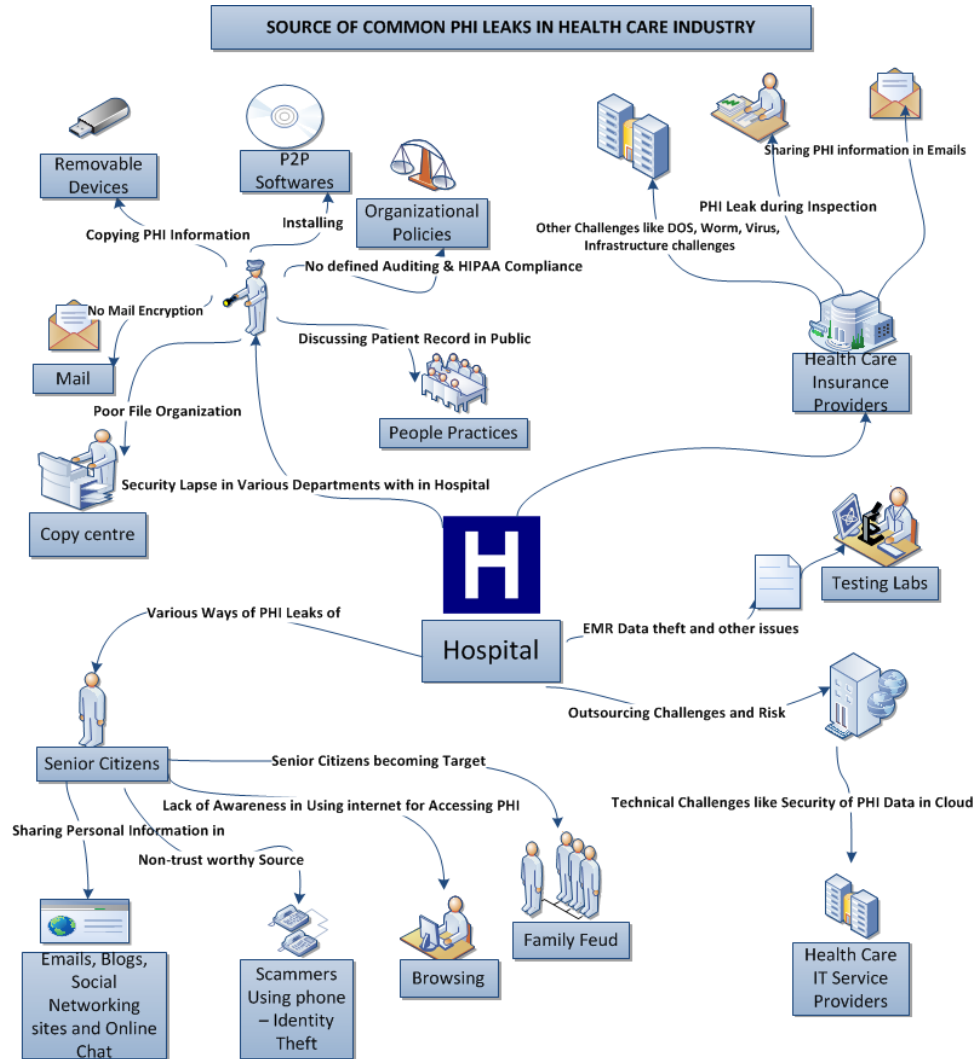

Figure 1. PHI leaks in Health Care Industry

5. CONCLUSION

We hope that this research will help in understanding the societal aspects of e-Health security which will help to build different systems that could help protect senior citizens from cyber crime attacks. This research will help in developing person-centered health systems that focus on defense before privacy attacks, rather than try to mitigate the effects after the attacks have happened.

6. LIMITATIONS AND FUTUREWORK

As this workshop is looking at game changing strategies to meet the cyber security challenges, we propose to compare and contrast e-health care services and cyber security related to the same. We then plan to map the similarities and differences in India and the U.S. This will help us to develop solutions that can lead to the design of better systems for India and this may also lead into changing the thinking in the U.S. Since the sample is a convenience sample, we may not be able to generalize the results to the entire population of India and the U.S., but we will be able to use this to build a larger study where we collect data from a statistically representative sample in both the countries.

The research focuses on US and India and it does not cover other countries, but we hope that by covering an individualistic society (the U.S.) and collectivist society (India), we cover a spectrum of societies in the world. We hope this research will provide an understanding of the problem from an international perspective.

7. ACKNOWLEDGMENTS

8. REFERENCES

[1] Blobel, B. "Comparing approaches for advanced e-health security infrastructures", International Journal of Medical Informatics, Volume 76, Issues 5-6, May-June 2007, Pages 454-459.

[2] Hofstede, G. Cultural and Organizations - Software of the Mind - Intercultural Cooperation and its importance for survival. 1991.

[3] Kumaraguru, P., and Cranor, L. "Privacy in India: Attitudes and Awareness". In Proceedings of the 2005 Workshop on Privacy Enhancing Technologies (PET2005) (30 May - 1 June 2005).

[4] Millward, P. "The grey digital divide: Perception, exclusion and barrier of access to the Internet for Older People". 2003. http://www.itu.int/wsis/docs/background/themes/digital_divide/grey_digital_divide.pdf, retrieved on March 17, 2010.

[5] Selwyn, N. "The information aged: A qualitative study of older adults' use of information and communications technology". Journal of Aging Studies 18(369-384). 2004.

[6] Selwyn, N., S. Gorard, J. Furlong, and L. Madden. "Older Adults' Use of Information and Communications Technology" in Everyday Life. Ageing & Society, 23, 561-582. 2003.

[7] Red Orbit Staff & Wire Reports. "Senior Citizens becoming more net savvy". April 11, 2010.

[8] Cox, Barbara Wood "Senior Citizens and Identity Theft. Protecting the Elderly from Phishing Scams" in http://consumereducation.suite101.com/article.cfm/senior_citizens_and_identity_theft. April 11,2010

[9] Free Press Release; Senior Citizens are Easy Targets for Identity Theft Scams by a Family Member in http://www.free-press-release.com/news/200406/1087597437.html. June 18,2004

[10] Wilson, Jamie K. Teaching Senior Citizens about Computers. http://www.associatedcontent.com/article/281822/teaching_senior_citizens_about_computers.html?cat=25. April 11, 2010

[11] Appari, A. and E. Johnson (August, 2008) "Information Security and Privacy in Healthcare " in http://www.ists.dartmouth.edu/library/416.pdf